Project Number:	671
Category:	Design/Construction of Fixed Bottom Turbines
Date:	November 2011
Subject:	Offshore Electrical Cable Burial for Wind Farms: State of the Art; Standards and Guidance; Acceptable Burial Depths and Separation Distances; and Sand Wave Effects
Performing Activity:	Offshore Risk & Technology Consulting, Inc.
Principal Investigator:	M. Sharples
Contracting Agency:	Bureau of Safety and Environmental Enforcement
Summary:	This study provided general guidance for electrical cable design and installation, guidance for acceptable separation distances, and special considerations for sand wave effects.
Key Findings:	• About 70% of insurance claims for offshore wind farms are related to submarine cables; no current standards exist for offshore wind farm cable design and installation. • Cable damage can put an entire wind farm out of service for months and can lead to damage to the turbine equipment. • Late changes in cable design can be problematic, due to an extensive backlog on cable supply. • Sand waves because of the potential to affect depth of burial or undermine installed cables present a significant challenge to cable installation and maintenance.
Recommendations:	• Currently, the right of way (ROW) for cables is specified as 200 ft. centered on a cable in 30 CFR Part 585; this should be increased to 250 m (820 ft.) on either side of the cable centerline. • The facility design report should provide documentation of interactions between design disciplines. It should include detailed design information on cables, including burial depth, minimum bending radius, factory acceptance tests, cable laying vessel equipment, and a cable repair plan. • Vertical separation between cables of 12 in. (1 ft.) is generally acceptable. • Horizontal separation between cables should be at least 20 ft. to avoid interference during repairs and at least 200 yd. (600 ft.) to avoid damage from ship anchors if additional export cable is installed for redundancy. • Cable burial depths should be between 1 to 2 m (3 to 6 ft.), except in ship anchorage areas, where 4.5 m (15 ft.) is recommended. • Mitigation actions for sand waves should be determined on a case-by-case basis and may include: sweeping the seabed before cable installation, increasing burial depth, protecting the cable with rock, or increasing monitoring and remediation as needed.

	• Cable design, fabrication, and installation should be reviewed by a qualified CVA. • Further research is needed of anchor embedment depth for soil types other than clay. • Research is needed to develop guidance on cable fabrication and installation testing procedures and on the scope of work for CVA or BOEM verification of design and installation. • Creation of a U.S. Cable Protection Committee comparable to the one in the UK is recommended.
Subsequent Studies/Activities:	• American Wind Energy Association (AWEA), *Offshore Compliance Recommended Practice* (2012), referenced this study for additional guidance on cable burial depth.
Report Link:	AA